ODONATA, PLANIPENNIA, AND TRICHOPTERA FROM LORD HOWE AND NORFOLK ISLANDS.

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(With ten Text-figures.)

The small but interesting collection of Odonata, Planipennia, and Trichoptera dealt with in this paper was made by Mr. A. M. Lea, F.E.S., Entomologist to the South Australian Museum. Mr. Lea collected on Norfolk Island from November 23rd to December 7th, 1915, and on Lord Howe Island from December 10th, 1915, to January 17th, 1916. I have to thank Mr. E. R. Waite, F.L.S., Director of the South Australian Museum, for the opportunity of studying this collection.

I am not able to accept the record of this collection, in the three Orders here dealt with, as in any probability at all a complete one. The result from Lord Howe Island is particularly disappointing, only two Planipennia, and no Odonata or Trichoptera being recorded. Probably the amount of permanent fresh-water on the Island is not sufficient to allow of the existence of many species of the last two Orders; but, at any rate, the flora is rich, and the Island would appear to be well suited to the existence of Planipennia. It is, indeed, remarkable that one of the two species recorded should belong to the purely Australian family *Nymphidæ*. A dweller in dense scrub, both in the larval and imaginal states, this insect flies very little; so that it would not be easy to explain its presence on the Island, unless it had come there originally from Australia, viâ some lost land-connection. The family is a very ancient one, and the Lord Howe Island species appears to be quite unlike the known Aus-

tralian species. These two facts suggest that it reached the Island a very long time ago.

With regard to Norfolk Island, the collection is a more extensive one, containing two species of Odonata, nine of Planipennia, and one of Trichoptera. The most striking feature here is the abundance of *Chrysopidæ*, of which seven species, apparently all new to science, were obtained. None of the species are the same as any known Australian species; so that the supposition, that these insects have been imported into the Island with Citrus fruit-trees, cannot be entertained. It seems much more likely that there is a large, indigenous, Chrysopid fauna in connection with the Norfolk Island Pine, *Araucaria excelsa*, since many Chrysopids are known to frequent the trees of this genus.

It is noteworthy that not a single species was found common to both Islands. The two Dragonflies from Norfolk Island are both found in the Kermadecs, and also in Australia, but are not known from New Zealand. The Caddis-fly is a common Australian species.

Of the Planipennia, all those already known to science are Australian species, the fauna showing a marked resemblance to that of Southern Queensland. The occurrence of the very rare and tiny Hemerobiid, *Carobius pulchellus* Banks, is noteworthy, since this is another very weak and inert species, which could scarcely have reached Norfolk Island except by means of some definite land-connection in the past. The forms of *Drepanacra* found on Norfolk island are dwarfed, and differ from both Australian and New Zealand forms sufficiently to merit new names. Insects of this genus would certainly not be transported by winds or storms, and must, like *Carobius*, be reckoned as definite evidence of a former land-connection between the Island and Australia.

The following is a list of the species in the collection :—

Order **ODONATA.**

Family LIBELLULIDÆ.

Subfamily CORDULIINÆ

(1) *Hemicordulia australiæ* Ramb. Norfolk Island.

Family AGRIONIDÆ.

Subfamily AGRIONINÆ.

(2) *Ischnura aurora* Br. Norfolk Island.

Order **PLANIPENNIA.**

Family HEMEROBIIDÆ.

(3) *Drepanacra instabilis* (McLach.) *insularis*, n.subsp. Norfolk Island.

(4) *Drepanacra norfolkensis*, n.sp. Norfolk Island.

(5) *Micromus tasmaniæ* Walker. Norfolk Island.

(6) *Carobius pulchellus* Banks. Norfolk Island.

Family CHRYSOPIDÆ.

(7) *Chrysopa anomala*, n.sp. Norfolk Island.

(8) *Chrysopa metastigma*, n.sp. Norfolk Island.

(9) *Chrysopa nautarum*, n.sp. Norfolk Island.

(10) *Chrysopa leai*, n.sp. Norfolk Island.

(11) *Chrysopa araucariæ*, n.sp. Norfolk Island.

(12) *Chrysopa waitei*, n.sp. Norfolk Island.

(13) *Chrysopa norfolkensis*, n sp. Norfolk Island.

Family NYMPHIDÆ.

(14) *Myiodactylus howensis*, n.sp. Lord Howe Island.

Family MYRMELEONTIDÆ.

(15) *Myrmeleon pictifrons* Gerst. Lord Howe Island.

Order **TRICHOPTERA.**

Family LEPTOCERIDÆ.

(16) *Notanatolica magna* Walker. Norfolk Island.

ODONATA.

1. HEMICORDULIA AUSTRALIÆ Ramb.

Four males and one female of this common but handsome species were taken on Norfolk Island. The specimens are dark, like those recorded from the Kermadec Islands. In Australia,

this species ranges along the Eastern Coast from Victoria to Queensland, becoming darker as it goes north. The Norfolk Island form closely resembles the specimens found round Sydney and northwards to Queensland.

2. ISCHNURA AURORA Br.

This tiny and very beautiful Dragonfly is evidently abundant on Norfolk Island, the collection containing 39 males and three females. Of the latter, one is the rare homochrome form (colouration as in the male); this form has only so far been recorded from Western Australia and the Northern Territory. The other two are the common heterochrome (black) form. The insect is abundant all over Australia, but does not occur in New Zealand.

PLANIPENNIA.

Family HEMEROBIIDÆ.

3. DREPANACRA INSTABILIS (McLach.) INSULARIS, n.subsp.

Differs from the type-form in its small size (forewing 6·5 mm. long by 3·6 mm. wide), and in its general resemblance to *D. humilis* McLach. The Radial Formula is 2 + 1 + 1 + 1 + 1 + 3 = 9, as in the type-form. Forewings distinctly falcate, with four small lunules not very well formed; costal area exceedingly broad at base.

Head, *thorax*, and *abdomen* brown; *antennæ* and *legs* paler brown. *Forewing* pale transparent brownish, with very indistinct transverse irroration of darker brown; a small hyaline area on the median fork; fenestella very small and indistinct. *Hindwing* very pale, almost hyaline, very slightly clouded along posterior margin to Cu_{1b}.

Type in Coll. South Australian Museum, Adelaide. Cotype in Coll. Tillyard.

Two specimens from Norfolk Island.

4. DREPANACRA NORFOLKENSIS, n.sp.

Forewing well pointed, but *not at all falcate*, 6·5-7·5 mm. long by about 3·5 mm. wide. Radial Formula 3 + 1 + 1 + 1 + 3 = 9, or 3 + 1 + 1 + 1 + 1 + 2 = 9; costal area excessively broad at base, so

that Sc appears to lie nearer to posterior than to costal border of wing. A distinct darkened pterostigma on all wings, that of forewing lying above the end of Sc, but not reaching the costal margin.

Head, *thorax*, and *abdomen* dark brown; antennæ and legs paler brown *Forewing* dark brown, richly irrorated with blackish-brown, irregular, transverse stripes and patches; lunules three, small; fenestella present, but indistinct; a large triangular area proximad from the lunules, and a smaller blotch between R and Cu, at about one-third of the wing-length from the base, dull blackish-brown; within the latter area is a tiny white spot on M. *Hindwing* tinged with pale brown, with a darker clouding along both costal and posterior margins, and upon the gradate veins.

Type in Coll. South Australian Museum, Adelaide.

A second specimen, obviously belonging to this species, lacks the two dark areas on the forewing, but possesses instead a longitudinal line of blackish-brown, running about midway through the forewing, from base to just below apex. I propose to name this var. *lineata*. It corresponds with the well known var. *longitudinalis* Tillyard, of *D. humilis* McLach. This specimen is in Coll. Tillyard.

5. Micromus tasmaniæ Walker.

Six specimens of this common Australian lacewing occur in the collection, from Norfolk Island. It is quite possible that they might have been introduced as eggs or larvæ on Citrus-trees or roses. The species also occurs in New Zealand.

6. Carobius pulchellus Banks.

A single, beautifully marked, but somewhat damaged, specimen of this very rare insect, from Norfolk Island. Only two or three specimens of this insect are known, from S. Queensland.

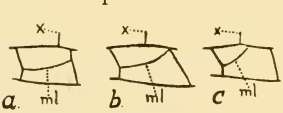
Family CHRYSOPIDÆ.

Key to the Norfolk Island Species.

(As the specimens are much faded and shrunken, neither the form of the prothorax nor the colour of the veins can be used as a reliable character).

	Median loop of forewing ending up coterminously with the third median cell; inner row of gradate cross-veins in forewing partially duplicated ..... *C. anomala*, n.sp.	
	Median loop ending well before the upper distal angle of the third median cell; inner row of gradate cross-veins in forewing not duplicated.....	1.
1.	Median loop of forewing ending up very little beyond the first cross-vein descending from Rs	2.
	Median loop of forewing ending up well beyond the first cross-vein descending from Rs, at nearly half-way between this cross-vein and the upper distal angle of the third median cell.....	3.
2.	Costal margin of forewing much arched, so that costal area is very wide for most of its length; pterostigma reddish-brown, very large in hindwing..... *C. metastigma*, n.sp.	
	Costal margin less arched, the costal area narrower at base and towards pterostigma; the latter very weakly formed, not dark in colour ..... *C. nautarum*, n.sp.	
3.	Larger species; expanse 28-29 mm.	4.
	Smaller species; expanse 24-25 mm.	5.
4.	Antennæ darkened at base: 7 inner and 7 outer gradate cross-veins in forewing ..... *C. leai*, n.sp.	
	Antennæ pale throughout: 6 inner and 8 outer gradate cross-veins in forewing ..... *C. araucariæ*, n.sp.	
5.	Forewing as narrow as hindwing; latter with 6 to 7 inner gradate cross-veins ..... *C. waitei*, n.sp.	
	Forewing much wider than hindwing; latter with from 3 to 5 inner gradate cross-veins ..... *C. norfolkensis*, n.sp.	

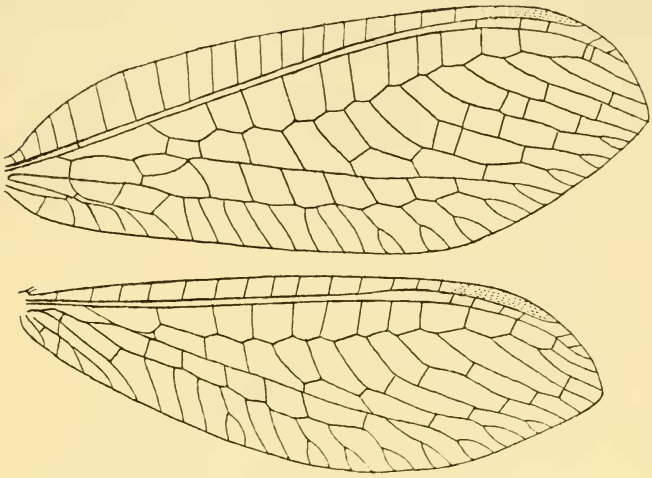
Owing to the peculiar structure of its median loop, and the partial duplication of the inner gradate series of its forewing, *C. anomala*, n.sp., might perhaps be regarded as forming the type of a new genus, intermediate in position between *Nothochrysa* and *Chrysopa*. I think it best, however, to leave it in *Chrysopa* for the present, until some really natural scheme of subdividing that enormous genus can be discovered. The differences in the formation of the median loop in *Nothochrysa*,



Text-fig. 1.*

* Third median cell of forewing in—*a*, *Nothochrysa*; *b*, *Chrysopa anomala*, n.sp.; *c*, *Chrysopa*, usual form; *ml*, median loop; *x*, first cross-vein below Rs.

Chrysopa anomala, n.sp., and the usual form in *Chrysopa*, are shown in Text-fig.1, *a*, *b*, *c*, respectively.



Text-fig.2.
Wings of *Chrysopa anomala*, n.sp.; (×7).

7. Chrysopa anomala, n.sp. (Text-figs.1*b*, 2).

Total length, 7·5 mm.; *forewing*, 12 mm

Wings distinctly pointed at apex, especially hindwing. All veins apparently originally green, except gradate series of forewing, which are darkened. Costal area of forewing only moderately wide, with 19 cross-veins. *Median loop* ends coterminously with the third median cell; the basal and distal sides of this cell very oblique. *Pterostigma* pale and weakly formed, with 3 cells below it in forewing, 4 in hindwing. *Gradate cross-veins* of forewing, 6 in each series, the inner series with three extra cross-veins placed just above it; in hindwings, 4 cross-veins in the inner, 5 in the outer series. Number of cells below M′ from median loop to wing-border in forewing, eight.

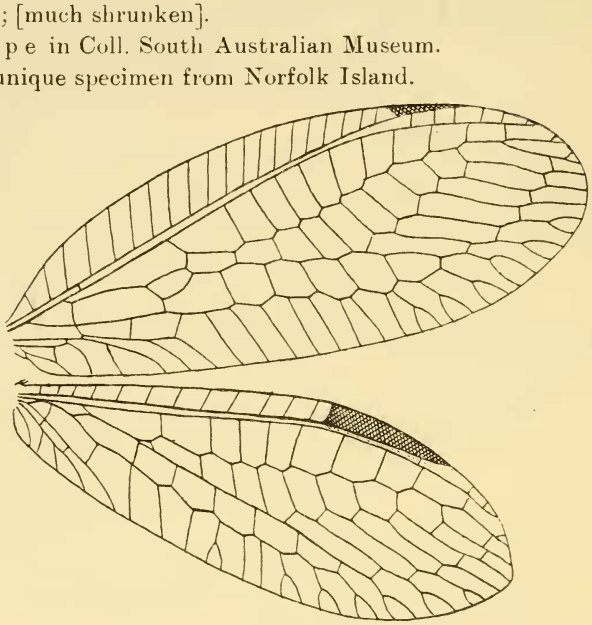
Head brownish; *antennæ* pale brownish, the basal joint much swollen.

Thorax: *prothorax* slightly longer than wide, much narrowed anteriorly. *Pterothorax* orange-brown. *Legs* very pale yellowish-brown.

Abdomen brownish, apparently with dark longitudinal bands; [much shrunken].

Type in Coll. South Australian Museum.

A unique specimen from Norfolk Island.



Text-fig.3.

Wings of *Chrysopa metastigma*, n.sp.; (×7).

8. CHRYSOPA METASTIGMA, n.sp. (Text-fig.3).

Total length, 7 mm.: *forewing*, 11 mm.

Wings broad, with well rounded tips. All the veins apparently originally green, except the gradate cross-veins, which are slightly darkened. Costal area of forewing much widened for most of its length, with 20 cross-veins. *Median loop* ends just beyond the first cross-vein descending from Rs *Pterostigma* 1 mm. in forewing, 2·3 mm. in hindwing, narrowly triangular, dark reddish-brown; 3 cross-veins below it in forewing. *Gradate cross-veins* 5 in inner, 6 in outer series in all wings. Number of cells below M′ from median loop to wing-border in forewing, seven.

Head orange-brown; *antennæ* pale brownish, the basal joint much swollen.

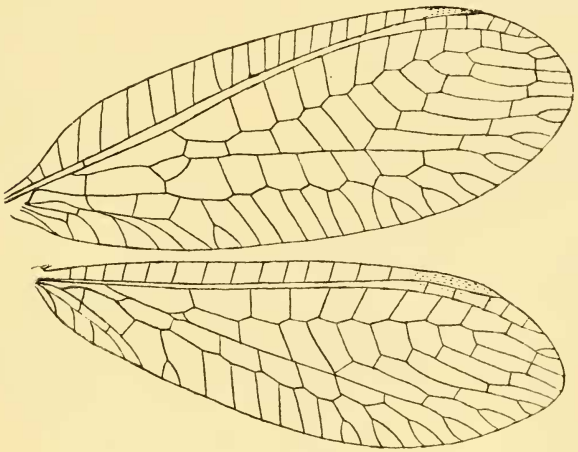
T h o r a x: *prothorax* large, about as long as wide, rich brown. *Pterothorax* yellowish-green. *Legs* pale yellowish-brown.

A b d o m e n pale brownish, marked with black lines dorsally along each side, and also in the sutures; [much shrunken].

T y p e in Coll. South Australian Museum.

A unique specimen from Norfolk Island.

This species resembles the Australian *C. olatatis* Banks, (Darwin, N.T.) in possessing a very prominent, reddish-brown pterostigma in the hindwing; but is at once distinguished from it by the more rounded wings, and the enlarged costal area of the forewing.



Text-fig. 4.
Wings of *Chrysopa nautarum*, n.sp.; (×7).

CHRYSOPA NAUTARUM, n.sp. (Text-fig. 4).

This species closely resembles *C. metastigma*, n.sp., in general shape, size, and structure, but may be distinguished from it as follows :—

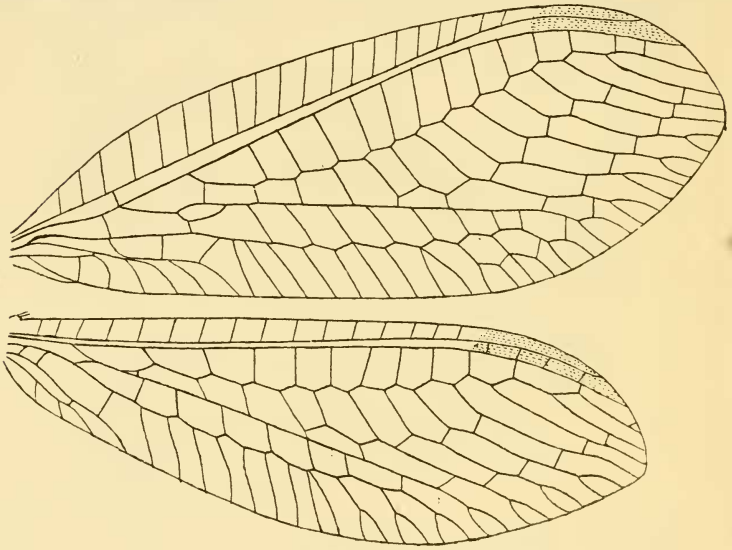
Size slightly smaller, *forewing* 10 mm. *Head* smaller, only just as wide as prothorax. Both head and prothorax reddish-brown; pterothorax and abdomen dark brown.

W i n g s broad, with well rounded tips, but hindwing not so broad in the pterostigmatic region as in *C. metastigma*, n.sp.

All the veins apparently originally green, without exception. Costal area of forewing wide, but not so wide basally and towards stigma as in *C. metastigma*. *Pterostigma* pale, weakly formed. Median loop, gradate series, and number of cells below M′ as in *C. metastigma*. (*Cf.* Text-figs.3, 4).

Type in Coll. South Australian Museum. Cotype in Coll. Tillyard.

Two specimens from Norfolk Island. Named after the early colonisers of the Island.



Text-fig.5.
Wings of *Chrysopa leai*, n.sp.; (×7).

10. CHRYSOPA LEAI, n.sp. (Text-fig.5).

Total length, 7 mm.; *forewing*, 13·5 mm.

Wings broad, the forewing somewhat rounded at tip, the hindwing slightly pointed. Venation apparently originally green, with the gradate series, costals, and some of the inter-radials darkened. Costal area of forewing only moderately wide, with 20 cross-veins. *Median loop* ends well beyond the first cross-vein descending from Rs. *Pterostigma* pale, well-formed, over

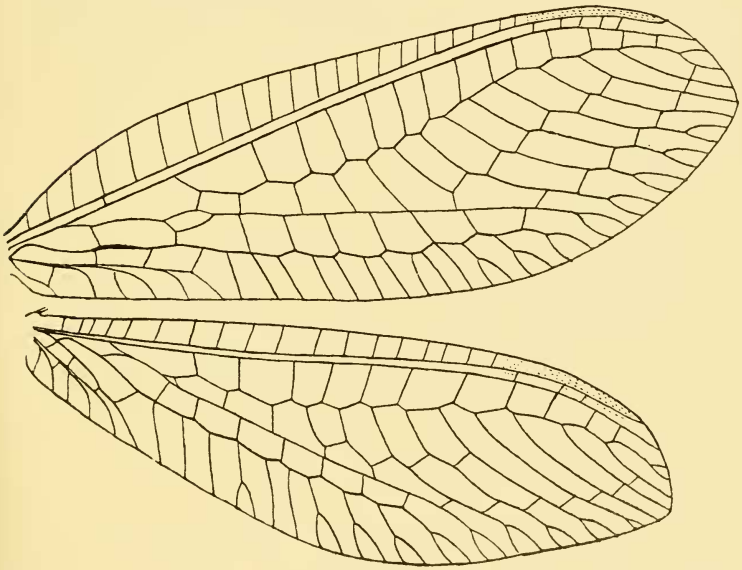
2 mm. long; 5 cross-veins below it in forewing. *Gradate cross-veins* in the forewing, 7 in each series; in the hindwing, 5 in inner, 6 in outer series. Number of cells below M′ from median loop to wing-border in forewing, ten.

Head dark brown; *antennæ* dark brown at bases, rest pale brown.

Thorax and abdomen brown. *Legs* pale brown. *Prothorax* slightly shorter than wide, dark brown.

Type in Coll. South Australian Museum.

A unique specimen from Norfolk Island.



Text-fig.6.

Wings of *Chrysopa araucariæ*, n.sp.; (×7).

11. Chrysopa araucariæ, n.sp. (Text-fig.6).

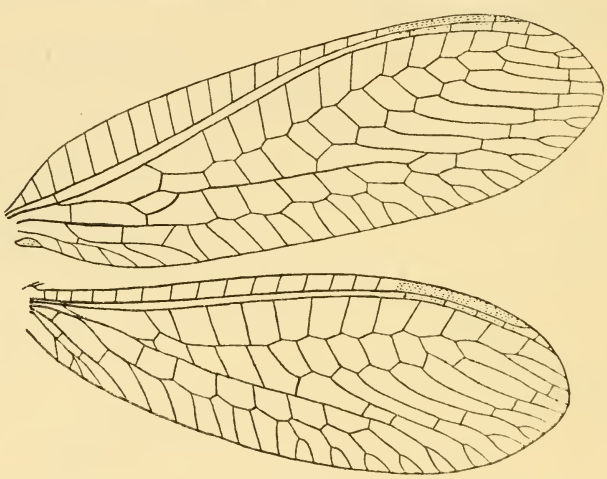
This species is closely allied to *C. leai*, n.sp., from which it may be distinguished as follows:—

Size a little larger, *forewing* 13·8 mm., the wings slightly more pointed. Costal area of forewing with 22 cross-veins. Only the gradate series of forewing darkened. *Pterostigma* pale and long in all wings; four cross-veins beneath it in the forewing. *Gradate*

cross-veins in the forewing, 6 in the inner, 8 in the outer series, both series slightly darkened; in the hindwing, 4 in the inner, 7 in the outer series. Number of cells below M′ from the median loop to the wing-border in the forewing, eight. The minute triangle of the hindwing is somewhat more evident than usual.

Type in Coll. South Australian Museum. Cotype in Coll. Tillyard.

Two specimens from Norfolk Island. The insect appears to be related to *C. latotalis* Banks, from Queensland.



Text-fig. 7.
Wings of *Chrysopa waitei*, n.sp.; (×7).

12. CHRYSOPA WAITEI, n.sp. (Text-fig 7).

Total length, 8 mm.; *forewing*, 11 mm.

Wings: all veins originally green. Costal area of forewing only moderately wide, with 15 cross-veins. Median loop ends well beyond the first cross-vein descending from Rs. *Pterostigma* pale, transparent, less than 2 mm. in both wings; three cross-veins below it in both wings. *Gradate cross-veins* in the forewing, 7 in inner, 7-8 in outer series; in the hindwing, 6-7 in inner, 7 in outer series; between the two series, in both wings, an extra cross-vein above M′, placed, in the forewing, very ob-

l iquely, at a point where M′ bends suddenly downwards. Number of cells below M′ from the median loop to the wing-border in the forewing, eight.

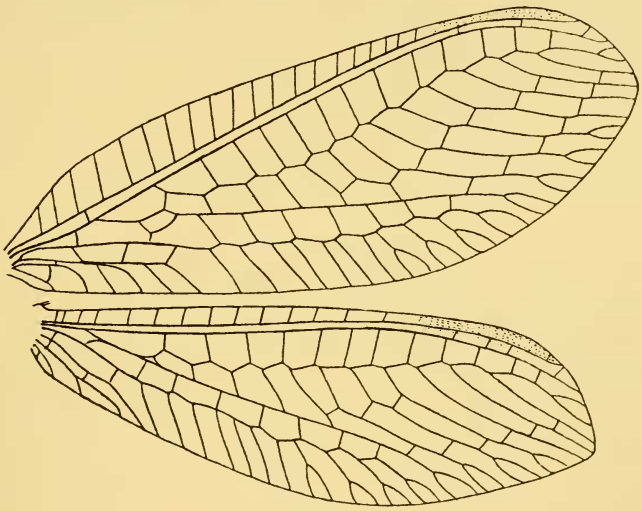
Head very small, orange-brown; *antennæ* pale brown, the basal joint much swollen.

Thorax: *prothorax* brown, longer than wide, narrowing anteriorly. *Pterothorax* brown, tinged with olive-green *Legs* short, pale brownish

Abdomen dull brownish; [much shrunken].

Type in Coll. South Australian Museum.

A unique specimen from Norfolk Island.



Text-fig. 8.
Wings of *Chrysopa norfolkensis*, n.sp.; (×7).

13. Chrysopa norfolkensis, n.sp. (Text-fig. 8).

Total length, 7·5 mm.; *forewing*, 12 mm.

Wings: all veins originally green, except the two gradate series of forewing, which are slightly darkened. Costal area of forewing only moderately wide, with 20 cross-veins. Median loop ends well beyond the first cross-vein from Rs. *Pterostigma* scarcely formed, 3 cross-veins below it in forewing. *Gradate*

cross-veins in the forewing, 7 in each series; in the hindwing, 3-5 in the inner, 6 in the outer series. Number of cells below M′ from the median loop to the wing-border in the forewing, eight.

Head brownish, moderately large; *antennæ* pale brownish.

Thorax: *prothorax* short, rather wide posteriorly, brown. *Pterothorax* brown. *Legs* pale brownish.

Abdomen dark brown, [much shrunken].

Type in Coll. South Australian Museum. Cotype in Coll. Tillyard.

Two specimens from Norfolk Island.

N.B.—In all the above descriptions of *Chrysopa*, n.spp., it should be borne in mind that the body is much shrunken, and the original colouration more or less lost. Probably there is a considerable amount of green or yellow on the thorax and abdomen of most of the species. For determination of the species, it is best to rely upon the wing-venational characters. In nearly all cases, the antennæ are more or less broken, so that they could not be used very well in the specific determinations.

Family NYMPHIDÆ.

14. MYIODACTYLUS HOWENSIS, n sp. (Text-figs.9-10).

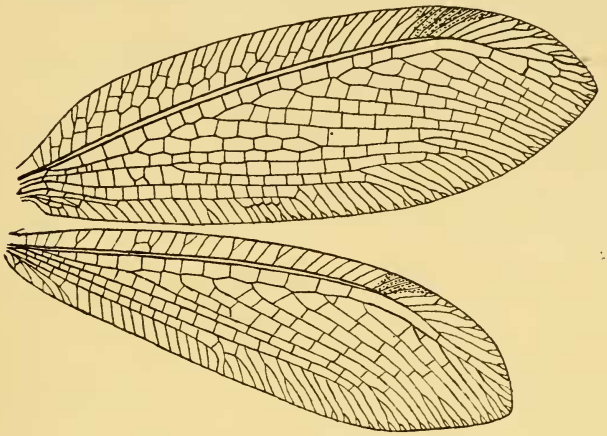
Total length, 15 mm.; *forewing*, 22 mm.

Wings rather narrow, well pointed, the veins very pale yellowish-green, touched here and there with blackish on some of the junctions and cross-veins of the forewings. *Pterostigma* 1 mm., trapezoidal, rose-pink. Rs with 9 branches in forewing, 8 in hind. Central "disc" not so sharply marked off as usual in this genus. Costal area of forewing only moderately widened, but the costal veinlets united for half the length of the wing from the base, by a series of cross veins; between these and the costal margin are five or six more cross-veins, forming a shorter anterior series.

Head wide, dull orange; *antennæ* thick, uniform, 8 mm., orange.

Thorax: *prothorax* narrowed anteriorly, orange-brown, with darker markings dorsally. *Pterothorax* pale orange. *Legs* pale yellowish-brown.

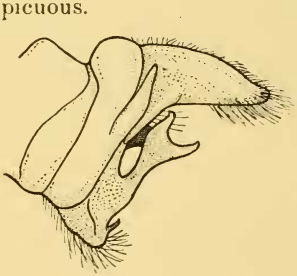
Abdomen lemon-yellow, with a broad, irregular, dorsal band of dark brown, interrupted at the sutures.



Text-fig. 9.
Wings of *Myiodactylus howensis*, n.sp.; (× 3½).

Appendages of male of extraordinary shape, as shown in Text-fig. 10; those of female not conspicuous.

Types, ♂♀, in Coll. South Australian Museum. Cotypes in Coll. Tillyard.



Text-fig. 10.*

Two males, a female, and a damaged specimen [half of abdomen lost], probably a female, taken on Lord Howe Island. In coloration, this species closely resembles *M. roseistigma* Esb.-Pet. It can at once be distinguished from that species by its much narrower and more pointed wings, by the two series of connecting cross-veins in the costal area of the fore-wing, and by the less definite closure of the "disc." In this last character, it approaches the genus *Osmylops*.

There is also, in the collection, a single larva of this species,

* Appendages of *Myiodactylus howensis*, n.sp., ♂, lateral view; (× 15).

about one-third grown, mounted on card, and somewhat shrivelled. This will be described later on, in a paper dealing with the life-histories of the Family *Nymphidæ*.

Family MYRMELEONTIDÆ.

15. Myrmeleon pictifrons Gerst.

This very common Queensland species is represented in the collection by four specimens from Lord Howe Island. These differ from the typical Australian form only by being slightly paler in colour, and in possessing a slightly more definite pterostigma.

Order **TRICHOPTERA.**

Family LEPTOCERIDÆ.

16. Notanatolica magna Walker.

A single female of this very common Australian species comes from Norfolk Island. The specimen is in good preservation, the greyish-brown colour of the forewings, in freshly-emerged specimens, being well in evidence.